Unraveling the early molecular and physiological mechanisms involved in response to phenanthrene exposure

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Résumé en anglais	Background Higher plants have to cope with increasing concentrations of pollutants of both natural and anthropogenic origin. Given their capacity to concentrate and metabolize various compounds including pollutants, plants can be used to treat environmental problems - a process called phytoremediation. However, the molecular mechanisms underlying the stabilization, the extraction, the accumulation and partial or complete degradation of pollutants by plants remain poorly understood. Results Here, we determined the molecular events involved in the early plant response to phenanthrene, used as a model of polycyclic aromatic hydrocarbons. A transcriptomic and a metabolic analysis strongly suggest that energy availability is the crucial limiting factor leading to high and rapid transcriptional reprogramming that can ultimately lead to death. We show that the accumulation of phenanthrene in leaves inhibits electron transfer and photosynthesis within a few minutes, probably disrupting energy transformation. Conclusion This kinetic analysis improved the resolution of the transcriptome in the initial plant response to phenanthrene, identifying genes that are involved in primary processes set up to sense and detoxify this pollutant but also in molecular mechanisms used by the plant to cope with such harmful stress. The identification of first events involved in plant response to phenanthrene is a key step in the selection of candidates for further functional characterization, with the prospect of engineering efficient ecological detoxification systems for polycyclic aromatic hydrocarbons.
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